neurons and the measuring microelectrode arrays. Pt nanopillars were found to serve as geometrically better focal adhesion points for cell attachment and thus enable high-quality signal recording. Therefore, vertical nanopillars can serve as a versatile platform to optically, electrically and chemically probe biological activities in live cells.

1035-Symp
Nanoelectronics Meets Biology
Charles Lieber.
Harvard University, Cambridge, MA, USA.
Nanoscale materials enable unique opportunities at the interface between the physical and life sciences, and the interface between nanoelectronic devices and biological systems makes possible communication between these two diverse systems at the length scale relevant to biological function. In this presentation, the development of nanowire nanoelectronic devices and their application as powerful tools for the life sciences will be discussed. First, a brief introduction to nanowire nanoelectronic devices as well as comparisons to other electrophysiological tools will be presented to illuminate the unique strengths and opportunities enabled at the nanoscale. Second, illustration of detection capabilities including signal-to-noise and applications for real-time label-free detection of biochemical markers down to the level of single molecules will be described. Third, the use of nanowire nanoelectronics for building interfaces to cells and tissues will be reviewed. Multiplexed measurements made from nanowire devices fabricated on flexible and transparent substrates recording signal propagation across cultured cells, acute tissue slices and intact organs will be illustrated, including quantitative analysis of the high simultaneous spatial and temporal resolution achieved with these nanodevices. Specific examples of subcellular and near point detection of extracellular potential will be used to illustrate the unique capabilities, such as recording localized potential changes due to neuronal activities simultaneously across many length scales, which provide key information for functional neural circuit studies. Last, emerging opportunities for the creation of powerful new probes based on controlled synthesis and/or bottom-up assembly of nanomaterials will be described with an emphasis on the creation of kinked nanowire probes capable of first intracellular transistor recordings. The prospects for blurring the distinction between nanoelectronic and living systems in the future will be highlighted.

1036-Symp
Exploring and Engineering the Cell-Surface Interface
Molly M. Stevens.
Imperial College London, London, United Kingdom.
This talk will provide an overview of our recent developments in bio-inspired nanomaterials for cell response and tissue regeneration (1,2). The highly interdisciplinary field of Tissue Engineering can greatly benefit from advances in the design of bio-responsive nanomaterials. TE involves the development of artificial scaffold structures on which new cells are encouraged to grow. The ability to control topography and chemistry at the nanoscale offers exciting possibilities for stimulating growth of new tissue through the development of novel nanostructured scaffolds that mimic the nanostructure of the tissues in the body. Recent developments in this context will be discussed as well as novel approaches to monitor cell and tissue development using live cell Raman microspectroscopy (3).
References
1. M. M. Stevens, J. George. *Science*. **310**, 1135 - 1138. (2005).
4. E. Place, N. D. Evans, M. M. Stevens, *Nature Materials,* **8**(6):457-470 (2009).
3. E. Gentleman et al, *Nature Materials,* **8**,9;763-770.(2009).
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1037-Symp
Separating the One From the Many-Microfabricated Arrays for Cell Separations
Nancy Allbritton.
University of North Carolina, Chapel Hill, NC, USA.
The separation of single or small groups of cells from within a heterogeneous population is a fundamental need in almost all areas of biomedical research. This effort is required in order to obtain unique cells possessing a desired characteristic for genetic studies, cloning, or other applications. Despite recent technological advances, selection and isolation of individual or small groups of live cells from a population remains a signicant challenge. Most live-cell separation methods require that cells be dispersed into a single-cell suspension, but removal of adherent cells from their growth surface may at times be undesirable. A microfabricated cell array platform composed of releasable elements in combination with either a pulsed laser or needle-based punch system has been developed for analyzing, sorting and collecting viable cells from a mixed population while the cells remain adherent to their growth surface. Both noadherent and adherent cells cultured on the array can be analyzed and selected using standard imaging methods. Target cells can then be collected with high viability and efficiently cloned by releasing the polymeric base or cup in which the cell resides. Benefits of this new approach include high cell viability, small sample size requirements, and broad cell selection criteria. Separation properties include fluorescence signals, morphology, and uniquely, time-dependent variables such as the transmission of properties to daughter cells, growth rate or signaling behavior. Mating the microarrays with image cytometry provides a high-throughput tool for selection and isolation of cells for biomedical and pharmaceutical applications.

SYMPOSIUM 12: What Drives Nucleic Acid Condensation?

1038-Symp
Statistical Mechanics of the Condensation of Linear Genome Molecules by Viral Capsid Proteins
Robijn F. Bruinsma.
University of California, Los Angeles, Los Angeles, CA, USA.
We present simple equilibrium and non-equilibrium statistical-mechanical models for the encapsidation of linear genome molecules by capsid proteins. During the first stage, the non-specific association of the genome molecule with capsid proteins is described by the theory of ''living polymers'', followed by a second stage of capsid nucleation and growth, for which we use the ''antenna'' theory of Grosberg and Shklovskii.

1039-Symp
Invited Speaker RNA and DNA, In and Out of Viral Capsids
William M. Gelbart.
Univ of California, Los Angeles, Los Angeles, CA, USA.
The genomes of the large majority of viruses are either single-stranded (ss) RNA or double-stranded (ds) DNA. This talk discusses the qualitatively different physical properties of these two molecules, and how they account for the qualitatively different genome packaging and delivery mechanisms of ssRNA and dsDNA viruses. The molecular sizes and shapes depend strongly on the degree and nature of secondary and tertiary structure, which are investigated by analytical and computational theory and by several experimental techniques including small-angle X-ray scattering, fluorescence correlation spectroscopy, and cryo-electron microscopy. Effects of di- and poly- valent cations, and of nucleotide sequence, are explicitly considered.

1040-Symp
How Entropic Forces can Drive Chromosome Organization
Bela Mulder.
FOM Institute AMOLF, Amsterdam, Netherlands.
We argue that above an appropriate length scale all chromosomes will behave as flexible polymers. This implies that many large scale features of chromosomal organisation, be it in pro- or eukaryots, can be understood on the basis of the physics of polymers. The dominant organisational principle involved is entropy, the universal, and non-specific, tendency of systems with many degrees of freedom to optimally ''fill'' their available phase space. Using computer simulations of effective representations of chromosomes we can probe this behaviour and its consequences. We will discuss the examples of chromosome segregation in E. coli, the nuclear organisation of the model plant system A. thaliana, and spatial distribution of eu- and heterochromatin in the human nucleus.

1041-Symp
Condensing Chromosomes to Effect Chromosome-Wide Regulation of Gene Expression and Meiotic Crossovers
Barbara Meyer.
HHMI and U. C. Berkeley, Berkeley, CA, USA.
Chromosomes must be properly expressed and segregated for genome stability. Proper condensation of chromosomes is pivotal for the successful execution of both processes, which are controlled in the small round worm *C. elegans* through paralogous protein complexes. One complex, the condensin complex, is essential for chromosome compaction and resolution during mitosis and meiosis. A highly related complex is critical for the process of X-chromosome dosage compensation, an essential, chromosome-wide regulatory mechanism that balances gene expression between sexes (e.g. XX female, XY or XO male) that differ in their number of sex chromosomes. The *C. elegans* dosage compensation complex (DCC) is targeted to both X chromosomes of hermaphrodites to repress transcription by half. Not only does the DCC resemble condensin, it shares components with condensin, and DCC components also participate in chromosome segregation and the regulation of crossovers during meiosis. The talk will focus on the changes in chromosome structure effected by paralogous condensin complexes to achieve proper gene expression and chromosome segregation.